$$V_{OUT} = \frac{V_{S+} - V_{S-}}{1 - p_1}, \text{ FOR } 0 \le p_1 \le 1.$$

The factor p_1 models the relative position of the wiper as it moves from one end ($p_1=0$) of the potentiometer to the other end ($p_1=1$). The number of values p_1 can assume is a function of the number of taps on the potentiometer. The sensor gain is inversely proportional to $(1-p_1)$, is pseudo-logarithmic, and varies from less than unity to 31 for a 32-tap potentiometer, such as the CAT5114, and to 99 for a 100-tap potentiometer, such as the CAT5113. The voltage, V_{REF}, represents a programmable offset voltage for the signal-conditioning circuit. You can easily implement the reference voltage by using a digitally programmable potentiometer configured as a programmable voltage divider.

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Add CAD functions to Microsoft Office

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Microsoft Word has excellent drawing capabilities. You could use it effectively to perform some CAD tasks, such as schematic entry. Word is by far the most popular text processor on the market, and it would seem desirable for technical writers to be able to create a single integrated document file combining both text and graphics in an editable format. Of course, many third-party drawing or CAD packages are available, but most of them cost a significant sum. Also, the use of third-party software components could raise licensing issues. Moreover, in a shared development situation, you could face a document-interchangeability problem. Some of your coworkers may lose the ability to perform schematic editing if the third-party component is not installed on their computers. This Design Idea provides a great deal of flexibility, because anyone who has Word can create and modify drawings using standard Word features.

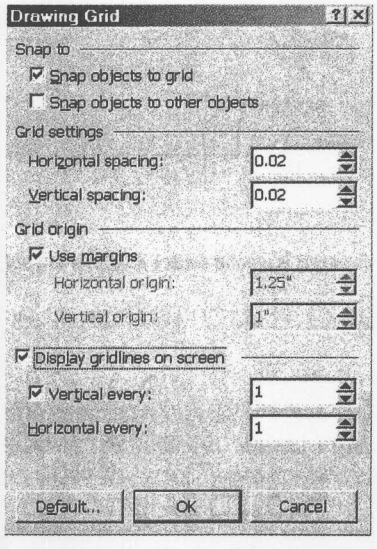

Figure 1 To display this dialogue box, click on the "Draw" button in the Drawing Toolbar, shown in Figure 2.

You can add some "convenience features" that can ease the schematic-entry process within Word. The first step is to create an Electronic Components Symbol Library and add it to the Clip Gallery. You can use those clips with Word or any other Microsoft Office application. These applications support drawing basically in the same way, with their built-in AutoShapes and Clip Art collection. In addition, you can use Clip Gallery with other graphics editors that support object linking and embedding. You can even use Clip Gallery as a stand-alone program. (For more information, refer to Microsoft Help for the Clip Gallery and related topics.) The task of creating the components library comprises several steps.

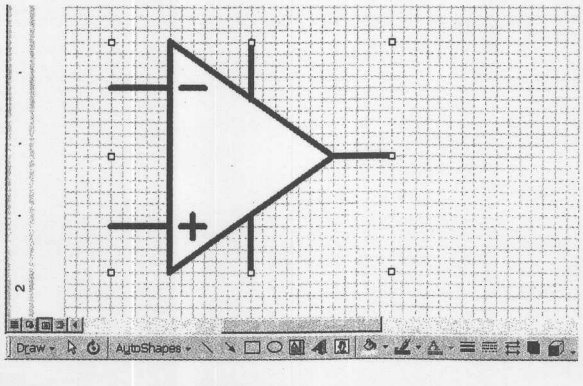

Figure 2 Create the component symbol by using Drawing Toolbar objects and then group them.

First, open a new file and then adjust the grid-line settings. You can reduce "Horizontal Spacing" and "Vertical Spacing" to 0.02 in. for good resolution. Make the gridlines visible by checking the box, "Display gridlines on screen" (**Figure 1**). To make the Drawing Grid dialogue box pop up, use the Drawing Toolbar button, labeled "Draw" in **Figure 2**. Set the scale to its maximum: 500%. Save the file as a Template by using the "Save As" option and choosing "Save as Type: Document Template" with extension .dot (for example, MyCad.dot) in the Word Templates default folder and then close the file. Now, when you open the new file for drawing, use this template as follows: Go to the "File" menu item, click the "New" subitem, and then choose the "MyCad" template. Note that the grid lines are not printable objects; they are visible only on the screen. You could type the text, draw the schematic, and then turn the grid lines off in the final document.

The next step is to create the symbol and add it to the Library. Use Drawing Toolbar objects via the corresponding buttons (**Figure 2**). After you have finished the drawing, select

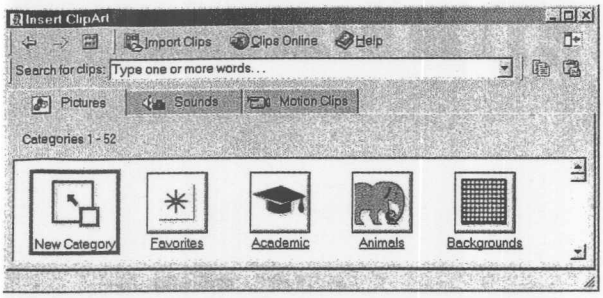

Figure 3 You can use the Clip Gallery with many Microsoft Office applications and even in stand-alone mode.

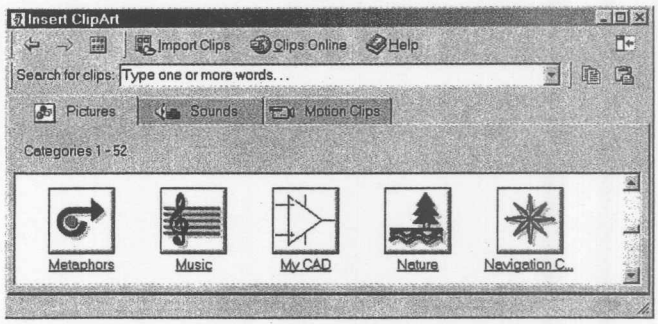

Figure 4 Add the new category, "MyCad," which serves as your Components Library.

all of its constituent parts by pressing the Shift key and holding it down while making the selection and then right-click the mouse on the pop-up menu, select the "Grouping" item, and click "Group." Now, Word treats the created component symbol as Clip or Auto Shape Object, which you can move, resize, and format as a whole image. To edit a part of the symbol image, you should first ungroup it, make the necessary changes, and then group it again. To add symbols to the Library, you should first create a new category in the Clip Gallery, which serves as a "container" for your graphic images and then copy and paste the symbols into the Gallery. The procedure is as follows:

1. Open the Clip Gallery by clicking on the icon "Insert Clip Art" located at the Drawing toolbar.
2. Click on the "New Category" icon (**Figure 3**) and type the name (for example, MyCad) for your Library when prompted, then click "OK."
3. Check to see whether the new "MyCad" category icon appears in the Clip Gallery window (**Figure 4**) and then click on the icon to open it.
4. Select the component you want to add to the Library and copy it to the clipboard (the shortcut for the "Copy" command is Ctrl-C).
5. Paste the component to the "MyCad" Category (the shortcut for the "Paste" command is Ctrl-V). Type the name for the symbol when prompted and then click "OK."
6. Repeat steps 2 to 5 for any components you want to add.

Figure 5 shows a variety of symbols in the MyCad Category. The usage of the Components Library is straightforward and similar to the usage of built-in Clips. To insert the symbol image into you document, you could use the Clip Gallery's standard "Import Clips" feature or the "Drag-and-Drop" option, depending on your personal preference. The Clip Gallery has a Help utility you can use to obtain more information. You could further improve ease of use by adding macros to automate the most common tasks, such as resizing, rotating, or flipping objects or adding labels, for example. You can assign the macros to shortcuts (certain key combinations). However, only qualified users, who have extensive experience dealing with VBA/macros, should attempt these operations. Also, you must be aware of the security issues associated with the use of macros in the applications:

- Some macros can perform potentially dangerous and harmful actions, and some of them may contain viruses. Use the macros at your sole risk without warranty of any kind.
- When using the Clip Gallery in a shared-development environment, and also with regard to network-installation or distribution issues, refer to the licensing/legal information, "Legal restrictions for using clips provided in the Clip Gallery" in the in the Help menu and the Microsoft Office End-User Legal Agreement, because certain restrictions could apply.

You can download several sample macros from the Web version of this article at www.ednmag.com. You can use them to Add Label to the selected graphic component, to resize the component or to rotate it 45° clockwise. You can store macros in the Macro Module that you add to the default Normal.dot template, thus affecting all opened documents. Alternatively, you can store the macros in the Template Macro Module within the MyCad.dot file. In this case, the macros are available only for opened documents based on the MyCad template file. For more information on creating and storing template files, refer to the Microsoft online Help features.

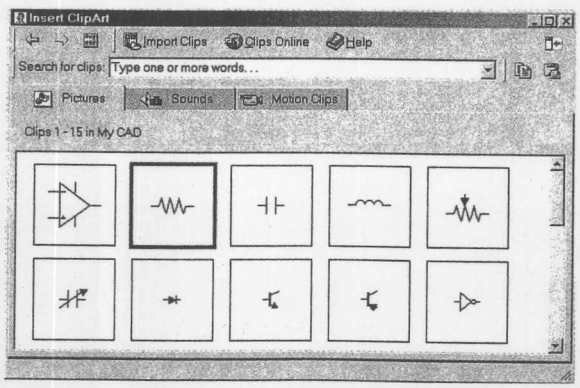

Figure 5 After adding the components to the Clip Gallery, you can use them in the same way you'd use built-in Clips.

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